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Experiencing the Food Safety Regime: Compliance, Market Access, and Coping Strategies of Indian Fishery Sector§

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Abstract

This paper has attempted to capture the impact of food safety standards on seafood exports from India. The research issues contemplated in the study are: (i) quantifying the trade effects on fishery exports from India due to the evolving stringency of international food safety standards, (ii) structural changes of export dynamics in the standards regime, and (iii) analysing the implications of standards-related compliance on participation of actors in the export value chain. A unidirectional gravity model (for the period 1998-2013) has been used, wherein, India's fishery exports to 34 countries has been modelled by taking food safety standard as the key independent variable. The structural changes in export dynamics are captured through the constant market share analysis and export market diversification analysis. To understand the forms of coordination in the seafood export value chain, snowball sampling technique has been adopted to select the key informants of the value chain. The study has revealed that the regulations are trade restrictive, and the standards regime is causing a major restructuring of the existing value chain. It is inevitable that India should elevate the national system for testing, certification and laboratory accreditation so as to be at par with the prevailing international trade regulatory safety parameters.

Key words: Food safety, seafood industry, value chain, fishery sector, seafood export

JEL Classification: F14, F18, L15, Q17, Q18

Introduction

An entirely new regime of food safety standards on India's fishery exports was enforced and made mandatory by the European Union from 1997 onwards, which eventually directed a provisional prohibition on seafood exports from the country and succeeded a catastrophe in the fishery export sector when the necessary regulations were tough to comply within a short span of time. Subsequent to this, in December 1999, USA which was another important destination of seafood from India, came up with mandatory HACCP seafood law (Henson and Jaffee, 2006). Nevertheless, the seafood processing and exporting industry proactively occupied in restructuring its activities in line with the food safety requirements of the destination markets, with the encouragement of government institutions. Having experienced some serious setbacks and restructuring of the seafood industry, it is interesting to analyse the impact of such a reshuffling process on the export competitiveness of the sector. The relevance of the present study lies exactly in this context. It is a known fact that several factors in isolation and with synergy decide the trade competitiveness of a nation. Therefore, it is crucial to delineate and highlight the key factors which affect the trade competitiveness. Moreover, such an attempt would certainly hold important stakes in policy

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decisions. With this back drop we attempt to analyse the impact of India's seafood export performance in the regime of food safety regulations and the resultant evolution of coping strategies. Specifically, this research paper (1) quantifies the trade impact of evolving international food safety standards on Indian fishery sector, (2) analyses the export competitiveness of India in the food safety regime, and (3) highlights the changing governance pattern of the fishery value chain due to the institutional changes.

There are several factors which determine the export competitiveness of a nation, the relative market share of a country's exports in the international market is the ready reckoner of its competitiveness. The paper has adopted a Constant Market Share (CMS) approach to study India's export performance of fishery sector, especially in the regime of food safety regulations. In the present study, we put forth the hypothesis that evolving stringent food safety standards imposed by the developed countries will have a ripple effect along the entire supply chain originating from a developing country, which may cause restructuring of the seafood value chain. The study has covered the entire seafood value chain (including the up-country market) using the theoretical framework of Global Value Chain[1] to analyse the influence of food safety standards on governance structure of the value chain.

Data Sources

The data on international trade were sourced from the Commodity Trade Database (COM-TRADE) of the United Nations Statistics Division and are for the period 1998 to 2013[2]. Select bilateral trade data were also taken from the *Statistical Bulletin* of the Marine Products Export Development Authority (MPEDA), Cochin. The study focused on member countries of the European Union (EU), Organization for Economic Co-operation and Development (OECD)[3] and select countries in Asia. The variables like gross national product (GNP) and population were taken from the UN Statistical Division's database (National Accounts statistics). They were taken in constant US dollars of 1995. In the initial model, variables like Exchange Rate and Inflation were considered and the data were sourced from *International Financial Statistics* (IFS) and CD ROM database of International Monetary Fund (IMF). Data on distance from Indian ports to other cities in the world were obtained from the website: *www.mapcrow.info*. Data on Cadmium (Cd) regulations were sourced from a range of databases which included USFDA, Codex reports, and the European Commission Regulations (EC) No. 466/2001.

Analytical Framework

Panel Data Analysis

Quantifying the elasticity of regulation is much complex since regulations affect market supply and demand in various ways (Wilson and Otsuki, 2004; Roberts and Unnevehr, 2005)**.** Panel data can be estimated using several methods which include fixed effects, random effects and mixed models. We have estimated gravity model for the total fish and fishery products (aggregate level) exports from India using the available data set. To determine the elasticity of food safety on Indian seafood exports, a uni-directional gravity model was used where India's total seafood exports to 34 countries was modelled by taking food safety standard/sanitary regulation as the key independent variable, apart from the typical gravity variables such as size of the economy and geographic distance, and the model is depicted as Equation (1):

$$\ln(X_j)^t = b_o + b_1\ln(Trade_j)^t + b_2\ln(IMP_j)^t + b_3 \ln(PCAPINCOM_j)^t + b_4\ln(CAD_j)^t + b_5 \ln(DIST_j)^t + b_6\ln(Tarriff_j) + b_7(TA_j) + b_8(ER_j) + b_9(GDP_j) + b_{10}(POP_j) + b_{11}(TGDP_j) + e_j^t \quad \ldots(1)$$

[1] Global value chains (GVC) refers to a set of intra-sectoral linkages between firms and other actors through which the geographical and organizational reconfiguration of global production is taking place. The GVC analysis highlights the concrete practices and organizational forms through which a specific division of labour between lead firms and the other economic agents involved in the conceptualization, production and distribution of goods in global industries is established and managed (Gereffi, 1996).

[2] The Harmonized Commodity Description and Coding System (Harmonized System, or HS), is adopted for fish and fishery products (HS 92 Code: 03). The Harmonized Commodity Description and Coding System (HS) is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization (WCO). HS is a six-digit nomenclature.

[3] There are overlapping member countries in EU and OECD. EU has more stringent standards regime compared to general OECD policy on food safety, though EU members are included in OECD.

where, the dependent variable $\ln(X_j)^t$ denotes the value of exports of seafood from India to the country (j) in year t. All these values are in natural logarithms. For the regulatory variable, the maximum residue limit (MRL) on *Cd* in the model was used as an independent variable. All observations are annual for the period 1998-2013, making the total number of observations 544. Use of the gravity model is ideal to get the level of trade restrictiveness of the MRL of *Cd*, which is a numerical value directly employable in the equation. Wherein $\ln(CAD)$ in Equation (1) is the variable for food safety, given as the maximum permissible level of *Cd* in OECD and Asia.

The gravity model of India's seafood exports was estimated taking all the explanatory variables in Equation (1) for all the observations. The variables like ER_j (Exchange rate), POP_j (Population), GDPj and $TGDP_j$ (trade: GDP ratio) which were either found to be insignificant or had strong multicollinearity to other retained independent variables, were dropped. Thus, the final estimated gravity Equation was:

$$\ln(X_{ij})^t = b_o + b_1\ln(Trade_j)^t + b_2\ln(IMP_j)^t + b_3\ln(PCAPINCOM_j)^t + b_4\ln(CAD_j)^t + b_5\ln(DIST_{ij})^t + b_6\ln(Tarriff_j) + b_7(TA_j) + C_j + e_j^t \quad \ldots (2)$$

In Equation (2), j denotes the importing country and t denotes year. $\ln(X_j)^t$ is the value of exports of total fishery products from India to various countries (34 countries in the OECD and Asia). In the Right-Hand Side of the equation (RHS), $\ln(Trade_j)^t$ denotes the total trade of country j, $\ln(IMP_j)^t$ represents Import of fish products by country j, $\ln(PCAPINCOMj)^t$ stands for the per capita income of the importing country, $\ln(Tarriff_j)$ denotes Import tariff, and TA_j stands for common trade agreements. The proxy for transportation costs are captured by the variable $\ln(DIST_j)^t$ which stands for the geographical distance between the ports of exporters and importers. $\ln(CAD_j)^t$ is the variable to capture the trade effects of food safety stringency, given as the MRL on *Cd* in OECD and selected Asian countries. e_j^t is the error-term assumed to be normally distributed. Hausman test results indicated the suitability of fixed effects model as the hypothesis of random effect model was rejected (m= 30.56 with p <0.0001). Hence, the fixed effect model was employed in two stages; in the first step we will estimate the model given by Equation (3):

$$\ln(X_{ij})^t = b_o + b_1\ln(Trade_j)^t + b_2\ln(IMP_j)^t + b_3\ln(PCAPINCOM_j)^t + b_4\ln(Tarriff_j) + b_5(TA_j) + zjC_j + e_j^t \quad \ldots (3)$$

Here, a new variable C_j is introduced which measures the individual country effects which is assumed to be time invariant. Thus, in the estimation, dummy variables for countries (where j = 1,.....,34) are employed as independent variables, so that the effects on heterogeneous intercepts (countries) are isolated. The GLS regression is used which is corrected for heteroscedasticity and auto-correlation in the first step of the estimation. As one of the methods of estimating individual effects in the presence of time invariant regressors, transformation is used for estimations. The first step of estimation is done using all variables except distance and CAD_j for 544 observations. There is a problem with variables such as distance and regulation as the inherent transformation wipes them out if used along with other variables in the first estimation, because they do not vary across time. However, this problem is solved by estimating these variables in a second step, by running another regression with the individual effect as dependent variable and distance and regulatory variables as independent variables as described in the model below:

$$IE_{ij} = b_0 + b_1\ln(DIST_{ij}) + b_2\ln(CAD_j) \quad \ldots (4)$$

where, IE_{ij} are the individual effects, which are the individual country coefficients in the first step of estimation.

Constant Market Share Analysis

Tyszynski (1951) was the first one who employed the CMS analysis effectively to decompose the export performance (growth) into market size, market composition and competitiveness. Thereafter, this method was adopted by many researchers for explaining the export performance. A vital exposition of this method of analysis, specifically on the competitiveness term was provided by Richardson (1971). More critical expositions and theoretical arguments were put forth by Merkies and van der Meer (1988). However, It has also been employed by many authors to analyse the export performance of developing nations in terms of general competitiveness (Chen *et al*., 2000; Juswanto and Mulyanti, 2003; Nalin Kumar and Muraleedharan, 2007; Batista, 2008; Thi Anh-Dao Tran *et al.,* 2009; Jayasekhar *et al.,* 2013).

In the present study, the analysis was carried out by considering 34 export markets. It should be borne in mind that CMS approach is purely a procedure for disintegrating the growth in exports, and should not be seen in the purview of cause-effect association. This model disintegrates the causes of export dynamics and differentiates between shifts in market access (market share) and shifts in the size of these markets. In Equation (5), $(g^1 - g^\circ)$ stands for export growth in destination markets (individual countries). The growth component has been disintegrated into three market force components. Since in this approach individual country is given paramount emphasis, the component of country composition effect was not incorporated. The export decomposition model can be represented as:

$$g^1 - g^0 = R^0(E^1 - E^0) + \Sigma_i(R_i^0 - R^0) * E_i^1 + (g^1 - \Sigma_i R_i^0 E_i^1) \quad ...(5)$$

where,

g = Export of seafood from India to chief destinations (in quantity)

R = Export share of India in the overall quantum of export in the chief markets

R_i = The share of Indian exports in total imports of major individual countries

E = Overall quantum of seafood exports in major destination markets/countries, and

E_i = Individual importing country-wise total quantum of imports.

Note: Here 0 denotes base period and 1 denotes recent period (0 and 1 have been used as superscripts).

The component $(E^1 - E^0)$ represents the size of the market effect which implies change in the value of total exports to *i* over the period. If this augments / decreases, then even with a constant market share (R°), the exports will augment / decrease by $R^0 (E^1 - E^0)$. It is noteworthy that the overall change in demand of individual markets (Σ_i) causes the market size effect. On the other hand, market composition effect implies the shift/change in the export share of India in the major importing individual countries in comparison with the overall share of Indian seafood export for the importing markets as a whole, and for this computation we considered only the base period. Competitiveness effect $(g^1 - \Sigma_i R_i^0 E_i^1)$ can be termed as a left-over component in the analysis. It measures the wedge between the actual quantum of export that took place from India to the chief market destinations during the recent period under consideration and the hypothetical quantum of export which could have been realized had India maintained the same market share (of the initial/base period) in each individual country.

The competitiveness effect reflects the capability of an individual country to access international export markets and elevates the share of export despite unfavourable shifts in international demand. It is often inferred as a sign of dynamic capability of a country to counter the altering environment and adjust its supply conditions to international market situations. In a nut shell, the CMS analysis disintegrates the overall growth in individual exporting country into effect of market composition and effect of market size and in turn separates the competitiveness effect $(g^1 - \Sigma_i R_i^0 E_i^1)$ as a residual component of the analysis.

Value Chain Governance

The present study has adopted the analytical framework developed by Gereffi *et al.* (2005) wherein they have illustrated five different possibilities of coordination (market, modular, relational, captive, and hierarchy). As far as the value chain structure in the recent food safety regulatory regime, the insights obtained from the field study conducted in Ernakulum and Alapuzha districts of Kerala were utilized. During the field survey, 47 processing units and 32 pre-processing centres were covered and information was also collected through informal discussions with stakeholders of the seafood export sector. The snowball sampling technique was adopted to select the key informants of the value chain. Commission agents of the European importers were especially helpful in providing detailed information about the downstream end of the chain. They also provided the contact details of importers whom with they were dealing. Twenty-two importers responded positively to our queries and the information provided by them on downstream markets was very crucial in our analysis.

Results and Discussion

Results of Panel Data Analysis

The estimated coefficients for the variables are described in Table 1. The coefficients estimates can be

Table 1. Parameter estimates for fishery exports from India (aggregate)

Variables	Coefficients	Standard error
IMPj	0.658***	0.125
TRADEj	-0.139**	0.067
PCAPINCOMj	0.798***	0.195
TARIFFj	-0.003^{NS}	0.049
TAj	0.039*	0.175
Adjusted R^2	0.86	

Note: *,**, *** indicate significance at 10 per cent, 5 per cent and 1 per cent levels, respectively

interpreted as elasticities, as the model is estimated in the log linear form. In the model, the coefficient of import (IMP_j) has been found positive and highly significant. This implies that India tends to export more to countries which are the major importers of fish products. India's export to country *j* would increase by 0.658 per cent as the total fish import increases by one per cent in each country. Similarly, per capita income of importing countries has a positive impact on export from India (0.798 per cent increase in export for 1 per cent increase in per capita income). The increase in trade volume has depicted a negative impact in export whereas tariff has a negative role in export, as expected. There is an increase in export to countries having trade agreements with India.

The regulation has been found to be trade restrictive. The coefficient of the regulatory variable is positive and significant. The magnitude of the coefficient, which can be described as the elasticity of *Cd* MRL, shows a moderate response (in comparison with the coefficients of regulations which has been reviewed in this section) to regulations (Table 2). The value of 0.828 means that a 10 per cent tightening of regulatory stringency or a reduction in the maximum permissible level of *Cd* will result in a reduction of exports by 8.28 per cent. The positive sign of the regulatory variable also has to suggest that total fishery imports are greater for a country that has less stringent regulation on *Cd*. The distance variable is significant and has the anticipated negative sign, which indicates that India tends to trade more with its immediate neighbouring countries during the period of food safety regulations. The coefficient value is -0.147 which indicates that when distance between India and country

Table 2. Parameter estimates for regulatory and distance variables

Variable	Coefficient	Std. Error
$DIST_j$	-0.147***	0.034
CAD_j	0.828***	0.295

Note: *** denotes significant at 1 per cent level

j increases by 1 per cent, the bilateral trade between the two countries declines by 0.147 per cent.

The individual country effects indicate the propensity to export which are also the intercepts of the regression. There are several countries which show a high propensity to import from India. They are mostly from the Asia, exhibiting strong effects. Thus, Asian countries are major outlets for Indian fishery products. This reinforces that food safety regulations that these countries impose may have significant impact on Indian exports as the value of the coefficient indicates, adequately reflecting the policies of the Asian countries with regard to food safety regulations on the imports of agro-food products from developing countries.

Results of Market Share Analysis

The CMS technique was used to find the export performance of shrimps and cephalopods from India to the dominant seafood importing nations of the world. We purposefully selected a 13-year long period from 1999 to 2012, keeping view of getting adequate reflections on the restructuring that took place in the seafood processing and export industry of India. To avoid the influence of the single extreme value at the beginning or end of the selected period, we have smoothened the two ends by using averaging technique. The results of the analysis are presented in Table 3.

A look at the disintegrated factors determining the export growth of fish to the world market revealed that the effect of competitiveness was less. Moreover, the

Table 3. Decomposition of shrimp exports from India during 1999-2012

India's export growth	Index
Size of market effect	78.23
Market composition effect	25.79
Competitiveness effect	-4.02

effect of market composition showed a negative index which reflected a decline in export market share in comparison with the other competing countries. Apparently, a very high index of the market size effect implies that the growth in export was chiefly contributed by the enhanced import demand in the destination countries. It is evident from the analysis that during the food safety regime competitiveness of export of fish and fish products declined. Now, we know that competitiveness effect is a leftover term in this analysis and as such it would be erroneous, if we attempt to attribute competitiveness as the sole factor causing increase or decrease in export growth. Since it is a residual-term, many other factors which were not captured in the disintegration of export components would also get associated with the competitiveness-term. Nevertheless, we are certain to bring out the appropriate signalling for possible interventions at academic and policy levels.

Reflections from Field Study

Forms of Coordination along Different Nodes of Value Chain

It was observed that the landing site price for fish was about 23 per cent of the final retail price, which increased to 38 per cent of the retail price at the export point. Among the actors operating in the chain, the largest value-addition was made by the supermarket chain in shrimp. It has been observed that the margin realized by the actors keeps on escalating as one moves downstream of the value chain. More value addition and more profit realization of the supermarkets clearly reflect the power they could exert in the chain.

At the upstream end of the seafood value chain, captive coordination was observed between the boat owners/fishermen and the auctioneer which was very much linked with the informal credit provisions provided by the auctioneer. The market form of coordination was predominant between the auctioneer and the exporter's agent (as well as independent agents), wherein the product was sold to the highest bidder. The independent agents would sell the product to processing units (export firms) or to the pre-processing units (peeling sheds) and the market form of coordination is reflected in these nodes. The peeling units after minimal processing, supply the product to the export houses, and besides market coordination, there exists a relational coordination, especially between peeling sheds and export houses. The export houses provide financial support for upgrading these peeling sheds and in turn, a relational form of coordination is evolved in this node. Modular coordination co-exists along with the market coordination between exporters and export agents. In fact, the exporters mainly bear the risk of consignment rejection and due to the dependency of exporters on the EU importers, a captive form of coordination evolves between Indian exporters and EU importers.

Within the European segment, two types of coordination co-exists (market and relational) in all the nodes. Since in the European segment the actors have perfect information on product specifications and also have access to the product segmentation and final markets, it becomes a common responsibility for them and thereby it is characterized by the relational coordination between them. On the other hand, since the complexity of the information is low and switch over cost is meager, market form of coordination also exists in the downstream segment. Therefore, multiple forms of coordinations govern various internodes of the Kerala's seafood export value chain. However, in terms of the whole-chain governance, the seafood chain of Kerala is indubitably governed by the overseas buyers and thereby is dominated by the captive form of coordination.

Power Relations along Value Chain

It was observed that in Kerala, concentration and consolidation is taking place at the processing node of the seafood export chain wherein the number of exporters has come down and professional players are upgrading their position in the value chain. The most important aspect of the existing chain is the gradual disappearance of the independent pre-processing sector, which has been an integral part of the seafood value chain. The pre-processing node of the value chain is getting integrated to the processing sector causing a major transformation of the existing value chain. The shift to integrated pre-processing by EU-approved processing facilities led to the closure of a significant number of independent pre-processing operations. At the same time, the installed capacity has actually increased, reflecting consolidation of the sector.

The major downstream end of the seafood value chain of Kerala is the Europe, wherein European

Commission's Directorate-General for health and consumer protection, responsible for ensuring the entry of safe food to the EU, has tightened the stipulated food safety control system. The EU importers are also under the pressure to ensure the complete safety of the imported food by technically quantifying the low risk range of the product which are sold in the EU market. The proliferation of voluntary private standards in response to the market forces in the EU is another aspect of the stringent food safety regime.

The overseas respondents had perceived food safety control as one of the highest priorities within the fishery sector. Large supermarkets have consistently expanded their range of products in the recent period to include foods that were previously supplied by small specialist outlets. Consequently, many of these outlets have now vanished, leaving management of the food chain in the hands of large retail chains that fight with each other for market share. Will and Guenther (2007) have observed that eventually perhaps 15 huge retail chains will control 80 per cent of the fresh produce sales to an expanded EU population of 455 million. Such concentration of power basically moves the primary decision-making away from the developing country to the importing EU bloc.

An additional consequence of the increased pressure for 'safe' products on EU importers is their growing preference to deal only with large production units in the developing countries. This reduces the level of risk to the importers, as large producers are more able to undertake the compliance measures than small producers are. Unfortunately, for developing countries, this can result in the smaller producer being totally excluded from its major export market, which has already taken place in the processing node of the Kerala's seafood export value chain. The results from the field study of the upstream value chain apparently support this argument. To sum-up, the present seafood value chain from Kerala can indubitably be put in the bracket of buyer-driven chain or directed network. The concentration at the downstream end of the chain has its ripple effect all along the chain.

Conclusions and Policy Implications

The broad objective of the study was to understand the impact of international food safety regulations on the fishery sector of India. The study was initiated with the hypothesis that evolving stringent food safety standards imposed by the developed countries, will, not only affect the export firms alone, but the entire supply chain will be transformed accordingly. In the study, gravity analysis has been used to indicate the direction and magnitude of the effect on exports. The study has found that the stringent food safety regulations are trade restrictive as far as Indian fishery export is concerned. Another objective of the study was to understand the export dynamics of Indian seafood products in the context of evolving stricter food safety standards and regulations of the major export destinations. The purpose was to get an overall depiction and useful indication/signals in terms of export competitiveness. We have disintegrated the overall export growth during the period considered for analysis and found that there was deterioration in the export competitiveness.

The micro level field study has highlighted that the shift to integrated pre-processing by the EU-approved processing facilities has led to the closure of a significant number of independent preprocessing operations. At the same time, however, installed capacity has actually increased, reflecting the consolidation of the sector. The study has demonstrated the possible sectoral impact of the international policy changes like that of stringency in the food safety regulations on the developing countries. In the present case of the seafood value chain from India, a complete transformation of the value chain is clearly visible. From the long-term policy perspective, India should upgrade the national system for testing, certification and laboratory accreditation so as to be at par with the prevailing international trade regulatory safety parameters. In this regard, it is also important to focus on proactive capacity building activities in the entire seafood value chain of the country.

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